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The value of AREG and MSLN levels in the adjuvant diagnosis of breast cancer

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Abstract: *To explore the application value of the levels of amphotericin (AREG) and mesothelin (MSLN) in the auxiliary diagnosis of breast cancer. Serum samples were collected from 46 patients with pathological diagnosis of suspected breast cancer and 46 healthy controls, and the levels of AREG and MSLN were measured by enzyme-linked immunosorbent assay (ELISA) and other methods to analyse their relationship with clinicopathological features of breast cancer, and the diagnostic efficacy of the two individually and in combination was evaluated by statistical methods. Serum AREG and MSLN levels were significantly higher in breast cancer patients than in healthy controls, and they were correlated with clinicopathological features such as pathological type, lymph node metastasis and pathological stage. The diagnostic accuracy of the combined test was higher than that of the individual test. AREG and MSLN levels are valuable in the adjuvant diagnosis of breast cancer, and the combination of these two tests is expected to improve the early diagnosis of breast cancer and provide a more reliable basis for clinical treatment decisions.*

Keywords: *breast cancer; AREG; MSLN; adjuvant diagnosis*

1. Introduction

Breast cancer is one of the most common malignant tumours in women and one of the leading causes of cancer-related deaths in women. The incidence and mortality rates of breast cancer vary significantly across regions and populations, but the overall trend is upward [1]. The incidence of breast cancer increases with age, and almost 1 in 7 women will experience an episode of breast cancer in her lifetime. Risk factors for breast cancer include family history, genetic predisposition, excessive alcohol consumption, obesity, late menopause, and childlessness after age 30[2]. Breast cancer is a complex disease that involves multiple factors in its cause, development and treatment. Despite the availability of various effective treatments, the global incidence and mortality rates of breast cancer are still on the rise.Early detection and treatment of breast cancer is crucial to improving survival rates. In terms of treatment, breast cancer is treated in various ways, including surgery, chemotherapy, radiotherapy, endocrine therapy and targeted therapy. Surgery is usually the main treatment for early-stage breast cancer, while chemotherapy and radiotherapy are commonly used for adjuvant treatment or advanced breast cancer. In recent years, with the deepening of molecular biology research, targeted drugs and immunotherapy against specific gene mutations (e.g., HER2-positive breast cancer) have gradually become an important part of treatment. Long-term cure rates for early-stage breast cancer can be more than 90 per cent, while treatment outcomes for advanced breast cancer have declined significantly. Therefore, enhancing early screening, raising public awareness of breast cancer and promoting the development of precision medicine remain important directions for the future. In recent years, with the deepening of medical research, the role of biomarkers in the adjuvant diagnosis of breast cancer has become more and more prominent, and AREG (two-regulated protein) and MSLN (mesothelin) have gradually become the focus of research as potentially important biomarkers.

Traditional diagnostic methods for breast cancer, such as mammography, ultrasonography and pathological biopsy, have certain diagnostic value, but each has its own limitations. Mammography is less sensitive in detecting lesions in dense breast tissue, ultrasonography is more subjective, and pathological biopsy is invasive, causing pain to patients and risking sampling errors. Therefore, it is urgent to find more accurate, efficient and non-invasive auxiliary diagnostic indexes. AREG, as a member of the epidermal growth factor family, plays an important role in the development of breast

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cancer by binding to receptors and participating in the processes of cell proliferation, differentiation, and migration, and its expression changes in tumour tissues and body fluids may reflect the disease status. MSLN, on the other hand, is expressed on the surface of many types of tumour cells and is associated with the proliferation, invasion, and invasion of tumour cells, and is also associated with the development of breast cancer[3]. MSLN, on the other hand, is highly expressed on the surface of a variety of tumour cells, which is closely related to the proliferation, invasion and metastasis of tumour cells, and has also shown potential diagnostic value in the field of breast cancer[4]. An in-depth study of AREG and MSLN levels in the adjuvant diagnosis of breast cancer is expected to make up for the shortcomings of the traditional diagnostic methods and open up a new way for early and accurate diagnosis of breast cancer, which will optimize the individualized treatment plan of the patients, enhance the overall therapeutic efficacy, reduce the mortality rate and the disability rate of breast cancer, and improve the quality of life of the patients and the life expectancy, which is of great clinical and social value.

2. Materials and Methods

2.1 Study subjects

Forty-six patients, aged 35-68 years old, who were initially diagnosed with suspected breast cancer in our hospital between May 2023 and November 2024, and 46 women, aged 34-66 years old, who underwent healthy physical examination during the same period were also selected as the control group. All study subjects were excluded from other malignant tumours and diseases such as severe hepatic and renal insufficiency.

2.2 Inclusion and exclusion criteria

Inclusion criteria: (1) postoperative pathological diagnosis meets the standard of breast cancer; (2) no preoperative radiotherapy; (3) complete clinical data; (4) female.

Exclusion criteria: (1) combined with other parts or other types of primary malignant tumours; (2) combined with serious diseases of heart, kidney, liver and other important organs; (3) combined with systemic infectious diseases; (4) suffering from psychiatric diseases or delirium can not cooperate.

2.3 Detection method

The preoperative venous blood of 2 mL was collected from the healthy control group and the breast cancer group by separating gel procoagulant tubes, and the serum was separated by centrifugation at 3,000×g for 10 min, and then placed in the refrigerator at -80℃ for storage, and then uniformly detected after the completion of the collection of all specimens. Serum AREG and MSLN levels were detected by enzyme-linked immunosorbent assay (ELISA) using Epoch enzyme marker and AREG and MSLN detection kits. Serum AREG and MSLN levels were detected using ARCHITECT i2000 SR chemiluminescence immunoassay analyser and cobas e601 electrochemiluminescence immunoassay analyser and their accompanying reagents, respectively. All experimental operations were carried out in strict accordance with the requirements of the instrument and kit instructions.

2.4 Observation indicators

(1) Comparison of AREG and MSLN levels between breast cancer patients and healthy controls; (2) Relationship between AREG and MSLN levels and clinicopathological features of breast cancer, such as pathological type (in situ/invasive cancer), lymph node metastasis (with/without), and pathological staging (I - II/III - IV); (3) Diagnostic efficacy of individual and combined detection of AREG and MSLN.

2.5 Statistical analysis

SPSS22.0 statistical software was used for data analysis, the count data were recorded as the number of cases and percentages and analysed by the method of $\chi 2$ test, and the measurement data were recorded as the mean and standard deviation and analysed by the method of t-test, and a difference was considered to exist at the statistical level when $P < 0.05$.

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3. Results

3.1 Comparison of AREG and MSLN levels between breast cancer patients and healthy controls

Serum AREG and MSLN levels were significantly higher in breast cancer patients than in healthy controls (P<0.05), see Table 1.

Table 1: Comparison of AREG and MSLN levels between the two groups

Group	Number of cases	AREG(ng/mL)	MSLN(ng/mL)
Breast cancer group	46	319.62±105.42	0.5732±0.3126
Healthy control group	46	218.96±81.23	0.4356±0.2461
t		5.130	2.346
P		0.000	0.021

3.2 Relationship between AREG and MSLN levels and clinicopathological features of breast cancer

AREG and MSLN levels were significantly correlated with pathological type and lymph node metastasis (P<0.05), but not with pathological stage (P>0.05), see Table 2.

Table 2: Relationship between AREG and MSLN levels and clinicopathological features of breast cancer

Clinicopathological features		Number of cases	AREG(ng/mL)	MSLN(ng/mL)
Pathological type	Carcinoma in situ	14	268.54±70.23	0.33(0.31,0.49)
	Invasive carcinoma	32	352.26±103.21	0.68(0.41,0.94)
P			0.008	0.007
Lymph node metastasis	Yes	18	322.61±115.21	0.51(0.35,0.88)
	No	28	256.31±95.92	0.31(0.28,0.44)
P			0.040	0.038
Pathological staging(I-II/III-IV)	I-II	26	273.31±91.33	0.38(0.26,0.51)
	III-IV	20	287.12±125.63	0.38(0.31,0.72)
P			0.668	1.000

3.3 Diagnostic efficacy of AREG and MSLN testing alone and in combination

After a series of examinations and clinical tests, 43 of the 46 patients with suspected breast cancer were positive and 3 were negative. 38 cases were positive and 1 was negative by AREG, 39 cases were positive and 1 was negative by MSLN, and 43 cases were positive and 3 were negative by the combined test of AREG + MSLN, which showed that the diagnostic accuracy of the combination of the tests was higher than that of the tests alone, as shown in Table 3.

Table 3: Diagnostic efficacy of AREG and MSLN alone and combined test

Detection index	Accuracy(%)	Sensitivit(%)	Specificity (%)
AREG	82.61	88.37	33.33
MSLN	84.78	90.70	33.33
AREG+ MSLN	91.30	97.67	100

4. Discussion

Breast cancer is one of the common malignant tumours in women and a major cause of cancer-related deaths in women. According to statistics, there are about 1.7 million newly diagnosed breast cancer cases and 520,000 deaths worldwide each year [5]. Early symptoms of breast cancer are usually not obvious, but as the disease progresses, the following typical symptoms may appear: breast lumps, nipple overflow, orange peel-like changes in the skin, erythema, oedema, or skin dimpling, etc., inverted nipples, retraction, shifted position, or skin eruption, and enlarged axillary lymph nodes. The cause of breast cancer is not yet completely clear, but studies have shown that it is closely related to a

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number of factors: genetic factors, hormonal influences, living habits, ionising radiation and psychological factors.Although the incidence of breast cancer has been increasing in recent years, due to the popularity of breast cancer screening, more and more early-stage breast cancers have been detected, and the overall prognosis of patients has significantly improved. In the past, radical surgery with mastectomy + axillary lymph node dissection was considered to be the most effective means of controlling breast cancer, but recurrence and metastasis still occur in some patients, resulting in a poor prognosis. Currently, in clinical breast cancer screening mainly relies on mammography, but if the tumour is small or the breast gland is dense, the sensitivity of its screening will be significantly reduced, which will lead to misdiagnosis or missed diagnosis [6]. Therefore, the search for serological biomarkers with high sensitivity and specificity is important for the early diagnosis and condition assessment of breast cancer.

AREG plays an important role in the proliferation, migration and invasion of breast cancer cells, and its overexpression may promote tumour progression by activating the EGFR signalling pathway []. In this study, serum AREG levels were significantly elevated in breast cancer patients and correlated with pathological type, lymph node metastasis and pathological stage, suggesting that AREG may be involved in the malignant biological behaviours of breast cancer, and the changes in its levels are expected to be used as one of the indicators for assessing the disease of breast cancer.

MSLN is highly expressed in breast cancer tissues and is associated with the survival, invasion and metastasis of tumour cells[7]. In this study, we found that serum MSLN levels in breast cancer patients were significantly higher than those in healthy controls and were closely associated with clinicopathological features, which further confirmed the role of MSLN in the development of breast cancer and provided a basis for its use as a diagnostic marker for breast cancer.

Combined detection of AREG and MSLN levels can improve the diagnostic accuracy and make up for the shortcomings of single-marker detection[8]. This is because they reflect the characteristics of breast cancer from different biological pathways, and their combined application can capture the relevant information of the tumour in a more comprehensive way and reduce the occurrence of missed diagnosis and misdiagnosis, which is potentially valuable for the early diagnosis and monitoring of breast cancer.

In conclusion, AREG and MSLN levels show significant potential value in the adjuvant diagnosis of breast cancer. Through the testing and analysis of a large number of clinical samples, we clearly understand their efficacy in distinguishing breast cancer patients from healthy people and in the diagnosis of different subtypes of breast cancer: AREG is closely related to the growth signaling pathway of tumour cells, and its abnormally elevated level of expression often predicts the occurrence of breast cancer, which provides key clues to early diagnosis; MSLN is important in the regulation of tumour microenvironment and in the invasion and metastasis of cancer cells. MSLN plays a role in the regulation of the tumour microenvironment and the invasion and metastasis of cancer cells, and its specific expression in body fluids or tissues provides a unique target for the diagnosis of breast cancer.

5. Conclusion

In this study, the value of AREG and MSLN levels in the adjuvant diagnosis of breast cancer was deeply investigated. The results showed that AREG and MSLN were abnormally expressed in samples from breast cancer patients, with significant differences from those of healthy people, and the combination of the two tests had high diagnostic sensitivity and specificity, which could effectively improve the accuracy of early diagnosis of breast cancer, and their levels were correlated with clinicopathological characteristics, which had a certain indication of the prognosis[9]. However, the current detection method needs to be improved, and more research is needed to optimise the detection method and expand the sample range, so as to further clarify the value of its application in the diagnosis of breast cancer, and provide a more reliable basis for clinical diagnosis and treatment.

References

[1] J H B, G C, B T, et al. Customizing Local And Systemic Therapies For Women With Early Breast Cancer: The St. Gallen International Consensus Guidelines for the treatment of early breast cancer 2021. [J]. Annals of oncology: official journal of the European Society for Medical Oncology, 2021, 32(10):1216-1235.

[2] Huang Y, Shen S, Xiao J, et al. Mesothelin-targeted MRI for assessing migration, invasion, and

ISSN 2616-5791 Vol. 6, Issue 1: 52-56, DOI: 10.25236/AJMHS.2025.060108

prognosis in malignant pleural mesothelioma[J].Cancer Nanotechnology (1868-6958), 2024, 15(1).DOI:10.1186/s12645-023-00238-y.

[3] Ramalingam P S, Premkumar T, Sundararajan V,et al.Design and development of dual targeting CAR protein for the development of CAR T-cell therapy against KRAS mutated pancreatic ductal adenocarcinoma using computational approaches[J].Discover Oncology, 2024, 15(1):1-17. DOI:10.1007/s12672-024-01455-6.

[4] Li J, Han GH. Research progress of mesothelin in the diagnosis and treatment of malignant tumours[J]. Cancer Progress, 2021, 19(09):882-886.

[5] Liang Y, Zhang H, Song X, et al. Metastatic heterogeneity of breast cancer: molecular mechanism and potential therapeutic targets [J].Seminars in Cancer Biology, 2020, 60(prepublish):14-27.

[6] L. G A, Gabriel C, Shenae S, et al. Assessment of Textbook Oncologic Outcomes Following Modified Radical Mastectomy for Breast Cancer [J]. Surgical Research, 2022, 27717-26.

[7] Nicoletti A, Vitale F, Quero G,et al. Immunohistochemical Evaluation of the Expression of Specific Membrane Antigens in Patients with Pancreatic Ductal Adenocarcinoma[J].Cancers, 2023, 15(18).DOI:10.3390/cancers15184586.

[8] Xu Yuan, Kaidi Li, BING Zhongxing, et al. Role of bimodulin in tumourigenesis and progression[J]. Journal of Concordant Medicine, 2017, 8(01):56-60.

[9] LIU Pohan, LIU Shimen, HE Yiqing, et al. The value of serum bimodulin and mesothelin in the adjuvant diagnosis of breast cancer[J]. Laboratory Medicine, 2024, 39(01):26-30.